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Theme: Nanophotonics

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Research summary:

Our research focuses on design and synthesis/fabrication of functional nanostructures made of metals, semiconductors, oxides, and their hybrids/composites. Our aim is to control physical parameters (e.g., dimension, composition, shape, structure, etc.) of these nanostructures and to investigate their corresponding unique properties in the context of optics, electronics, optoelectronics, and mechanics as well as their responses toward interesting biological and chemical species. These fundamental studies work with forward-looking engineering efforts lead to the fabrication of unconventional devices, such as flexible electronics, sensory skins, intelligent surgical gloves, etc. Our current interests also include the use of plasmon-enhanced phenomena on the surfaces of noble metal nanostructures to exploit energy-oriented directions, for example, solarplasmonics and plasmonics-assisted reactions, through intensive collaboration with scientists in the Nanophotonics group of the CNM.

Selected publications:

1. Sun, Y.; Rogers, J. A., "Structural Forms of Single Crystal Semiconductor Nanoribbons for High-Performance Stretchable Electronics", *J. Mater. Chem.* **17**, 832-840 (2007). (highlighted with cover illustration)
2. Sun, Y.; Choi, W. M.; Jiang, H.; Huang, Y. Y.; Rogers, J. A., "Controlled Buckling of Semiconductor Nanoribbons for Stretchable Electronics", *Nature Nanotechnol.* **1**, 201-207 (2006).
3. Ahn, J.-H.; Kim, H.-S.; Lee, K. J.; Jeon, S.; Kang, S. J.; Sun, Y.; Nuzzo, R. G.; Rogers, J. A., "Heterogeneous Three-Dimensional Electronics by Use of Printed Semiconductor Nanomaterials", *Science* **314**, 1754-1757 (2006).
4. Sun, Y.; Kumar, V.; Adesida, I.; Rogers, J. A., "Buckled and Wavy Ribbons of GaAs for High-Performance Electronics on Elastomeric Substrates", *Adv. Mater.*, **18**, 2857-2862 (2006). (highlighted with inside cover illustration)
5. Sun, Y.; Kim, S.; Adesida, I.; Rogers, J. A., "Bendable GaAs Metal-Semiconductor Field Effect Transistors Formed with Printed GaAs Wire Arrays on Plastic Substrates", *Appl. Phys. Lett.*, **87**, 083501(2005).(highlighted with cover illustration)

6. Sun, Y.; Khang, D.-Y.; Hua, F.; Hurley, K.; Nuzzo, R. G.; Rogers, J. A., "Photolithographic Route to the Fabrication of Micro/Nanowires of III-V Semiconductors", *Adv. Funct. Mater.* **15**, 30-40 (2005). (highlighted with cover illustration)
7. Sun, Y.; Wiley, B.; Mayers, B.; Xia, Y., "Shape-Controlled Synthesis of Metal Nanostructures: The Case of Silver", *Chem. Eur. J. 11*, 454-463 (2005). (highlighted with cover illustration)
8. Sun, Y.; Rogers, J. A., "Fabricating Semiconductor Nano/Microwires and Transfer Printing Ordered Arrays of Them onto Plastic Substrates", *Nano Lett.* **4**, 1953-1959 (2004).
9. Sun, Y.; Wiley, B.; Li, Z.-Y.; Xia, Y., "Synthesis and Optical Properties of Nanorattles and Multiple-Walled Nanoshells/Nanotubes Made of Metal Alloys", *J. Am. Chem. Soc.* **126**, 9399-9406 (2004).
10. Sun, Y.; Xia, Y., "Mechanistic Study on the Replacement Reaction between Silver Nanostructures and Chloroauric Acid in Aqueous Medium", *J. Am. Chem. Soc.* **126**, 3892-3901 (2004).
11. Sun, Y.; Xia, Y., "Multiple-Walled Nanotubes Made of Metals", *Adv. Mater.* **16**, 264-268 (2004).
12. Sun, Y.; Xia, Y., "Alloying and Dealloying Processes Involved in the Preparation of Metal Nanoshells via a Galvanic Replacement Reaction", *Nano Lett.* **3**, 1569-1572 (2003).
13. Sun, Y.; Mayers, B.; Herricks, T.; Xia, Y., "Polyol Synthesis of Uniform Silver Nanowires: A Plausible Growth Mechanism and the Supporting Evidence", *Nano Lett.* **3**, 955-960 (2003).
14. Sun, Y.; Mayers, B.; Xia, Y., "Transformation of Silver Nanospheres into Nanobelts and Triangular Nanoplates through a Thermal Process", *Nano Lett.* **3**, 675-679 (2003).
15. Sun, Y.; Xia, Y., "Triangular Nanoplates of Silver: Synthesis, Characterization, and Their Use as Sacrificial Templates for Generating Triangular Nanorings of Gold", *Adv. Mater.* **15**, 695-699 (2003).
16. Sun, Y.; Mayers, B.; Xia, Y., "Metal Nanostrucutures with Hollow Interiors", *Adv. Mater.* **15**, 641-646 (2003).
17. Sun, Y.; Xia, Y., "Shape-Controlled Synthesis of Gold and Silver Nanoparticles", *Science* **298**, 2176-2179 (2002).
18. Sun, Y.; Xia, Y., "Increased Sensitivity of Surface Plasmon Resonance of Gold Nanoshells Compared to That of Gold Solid Colloids in Response to Environmental Changes", *Anal. Chem.* **74**, 5297-5305 (2002).
19. Sun, Y.; Xia, Y., "Large-Scale Synthesis of Uniform Silver Nanowires through a Soft, Self-Seeding, Polyol Process", *Adv. Mater.* **14**, 833-837 (2002).
20. Sun, Y.; Gates, B.; Mayers, B.; Xia, Y., "Crystalline Silver Nanowires by Soft Solution Processing", *Nano Lett.* **2**, 165-168 (2002).